WHAT IS CLAIMED IS:

1. A trace oxygen measuring apparatus being provided with at least one limiting current type oxygen sensor having an oxygen pump cell comprising an oxygen ion conductive solid electrolyte and a metal electrode, and a concentration detecting sensor, said limiting current type as a blank sensor or a measure sensor; wherein:

when said limiting current type oxygen sensor serves as a blank sensor, an oxygen concentration in a deoxidizing measuring gas obtained by feeding a measurement gas through an oxygen remover is measured by means of pump current of a limiting current type sensor:

when said limiting current type oxygen sensor serves as a measure sensor, an oxygen concentration in the measurement gas is measured by means of pump current of the limiting current type sensor; and

said apparatus has a mechanism for calculating difference in pump current between the measure sensor and the blank sensor as an oxygen concentration contained in said measurement gas.

2. A trace oxygen measuring apparatus according to claim 1, which is provided with a branching mechanism for branching said measurement gas; wherein:

a measurement gas passes through said oxygen remover by action of said branching mechanism and is then fed to said blank sensor; and

another measurement gas is directly fed to said measure sensor by action of said branching mechanism.

3. A trace oxygen measuring apparatus according to claim 1; wherein there is provided a switching mechanism for measuring values of pump current as a blank sensor and a measure sensor; said mechanism capable of switching over time wise in the following manner;

a deoxidized measurement gas after passing through said oxygen remover is fed during a period of time, and

said measurement gas is fed directly to said oxygen sensor during another period of time.

4. A trace oxygen measuring apparatus according to claim 1, wherein there are provided two limiting current type oxygen sensors each having an oxygen pump cell comprising said oxygen ion conductive solid electrolyte and a metal electrode, and a concentration detecting cell, and wherein one of the limiting current type oxygen sensor is used as a blank sensor, and an other limiting current type oxygen sensor is used as a measure sensor.

5. A trace oxygen measuring apparatus according to claim 1, wherein there is provided a feedback controller for controlling an electromotive force of the concentration detecting cell by feeding or discharging oxygen with current energizing the oxygen pump of said limiting current type oxygen sensor at a prescribed set voltage.

6. A trace oxygen measuring apparatus according to claim 5, wherein the set voltage of the electromotive force of the concentration detecting cell in said feedback controller is controlled to a voltage of up to 240 mV which corresponds to an oxygen concentration range of at least 2 ppm ensuring followup of the electromotive force - oxygen concentration characteristics of the concentration detecting cell to Nernst's formula.

7. A trace oxygen measuring apparatus according to claim 5, further comprising a special air duct communicating with open air as an oxygen source necessary for feedback control effected by said feedback controller.

8. A trace oxygen measuring apparatus according to claim 1, wherein:

said oxygen sensor is formed with a plurality of solid electrolyte layers; and

a first air duct, a second air duct and a measuring duct defined by said plurality of solid electrolyte layers;

said measuring duct has an oxygen discharge electrode and a concentration detecting electrode;

an oxygen pump cell formed of an oxygen feed electrode formed in said first air duct, and an oxygen discharge electrode formed in said measuring duct via the solid electrolyte layers formed between said first air duct and said measuring duct; and

a concentration detecting cell having an air reference electrode formed in said second air duct and a concentration detecting electrode formed in said measuring duct, via the solid electrolyte layers formed between said second air duct and said measuring duct; and

a mechanism for measuring the oxygen concentration in the measurement gas by measuring the oxygen pump current during feedback control through operation of the oxygen pump so that the electromotive force of said concentration detecting cell becomes a prescribed set voltage.

9. A trace oxygen measuring apparatus according to claim 8, wherein, in said oxygen sensor, the electrode present in the first air duct is an air reference electrode; the electrode opposite thereto is a concentration detecting electrode; the electrode present in the second air duct is

an oxygen feed electrode; and the electrode opposite thereto is an oxygen discharge electrode.

10. A method of measuring the trace oxygen concentration in a measurement gas containing trace oxygen by means of an oxygen sensor, comprising the steps of:

using said oxygen sensor, wherein:

said oxygen sensor is formed with a plurality of solid electrolyte layers; and

a first air duct, a second air duct and a measuring duct defined by said plurality of solid electrolyte layers;

said measuring duct has an oxygen discharge electrode and a concentration detecting electrode;

an oxygen pump cell formed of an oxygen feed electrode formed in said first air duct, and an oxygen discharge electrode formed in said measuring duct via the solid electrolyte layers formed between said first air duct and said measuring duct;

a concentration detecting cell having an air reference electrode formed in said second air duct and a concentration detecting electrode formed in said measuring duct, via the solid electrode layers formed between said second air duct and said measuring duct; and

a mechanism for measuring the oxygen concentration in the measurement gas by measuring the oxygen pump current

during feedback control through operation of the oxygen pump so that the electromotive force of said concentration detecting cell becomes a prescribed set voltage;

controlling the electromotive force set voltage of the concentration detecting cell in feedback control of said oxygen sensor to a prescribed voltage of up to 240 V which corresponds to an oxygen concentration range of at least 2 ppm ensuring followup of Nernst's formula of the concentration detecting cell electromotive force - oxygen concentration characteristics; and

feeding oxygen necessary for achieving a set oxygen concentration in the measuring duct from a special oxygen feed air duct communicating with open air.

11. A method of measuring the trace oxygen concentration in a measurement gas containing a combustible gas and trace oxygen by means of an oxygen sensor, comprising the steps of:

using said oxygen sensor, wherein:

said oxygen sensor is formed with a plurality of solid electrolyte layers; and

a first air duct, a second air duct and a measuring duct defined by said plurality of solid electrolyte layers;

said measuring duct has an oxygen discharge electrode and a concentration detecting electrode;

an oxygen pump cell formed of an oxygen feed electrode formed in said first air duct, and an oxygen discharge electrode formed in said measuring duct via the solid electrolyte layers formed between said first air duct and said measuring duct; and

a concentration detecting cell having an air reference electrode formed in said second air duct and a concentration detecting electrode formed in said measuring duct, via the solid electrode layers formed between said second air duct and said measuring duct;

using at least one such oxygen sensor having a mechanism for measuring the oxygen concentration in the measurement gas by measuring the oxygen pump current during feedback control through operation of the oxygen pump so that the electromotive force of said concentration detecting cell becomes a prescribed set voltage;

measuring the oxygen concentration of the measurement gas from which oxygen has been removed through the oxygen remover by means of the pump current value of the oxygen sensor; and

calculating the difference between the first measured oxygen pump current and the second measured oxygen pump current, as the oxygen concentration in the measurement gas, by measuring the oxygen concentration of the measurement gas, not having passed through the oxygen remover, by means of

the pump current of the oxygen sensor.

12. A method of measuring trace oxygen according to claim 11, comprising the step of feeding the measurement gas through the oxygen remover or not through the same by operating a switching mechanism, to the oxygen sensor.

13. A method of measuring trace oxygen according to claim 11, comprising the steps of:

using two oxygen sensors;

measuring the oxygen concentration of the measurement gas from which oxygen has been remove through the oxygen remover by means of pump current of the first oxygen sensor; and

calculating, as the oxygen concentration in the measurement gas, the difference between pump current of the first oxygen sensor and pump current of the second oxygen sensor by measuring the oxygen concentration of the measurement gas, not having passed through the oxygen remover, by means of pump current of the second oxygen sensor.

14. A device for generating oxygen in a trace amount comprising

a plurality of solid electrolyte layers;

an oxygen feed duct comprising a first air duct which is a vacancy defined by the solid electrolyte layers forming three continuous layers at least at an end thereof and an electrode feed electrode formed in the first air duct; and

an oxygen pump cell comprising an oxygen discharge electrode provided on the surface of the upper solid electrolyte layer forming said three layers, and an oxygen feed electrode formed in said first air duct;

wherein a constant current source/controller is arranged between the oxygen discharge electrode and the oxygen feed electrode so that prescribed current flows therebetween.

15. A device for generating oxygen in a trace amount according to claim 14, comprising

a second air duct and an air reference electrode provided in said second air duct;

wherein said air reference electrode forms a detecting cell which monitors a decrease in oxygen concentration caused by oxygen feed in the oxygen feed duct through a change in electromotive force by measuring electromotive force between the air reference electrode and the oxygen feed electrode in said oxygen feed duct.

16. A trace oxygen generating apparatus comprising a

plurality of solid electrolyte layers comprising:

an oxygen feed duct comprising a first air duct, which is a vacancy defined by solid electrolyte layers forming three continuous layers at least at an end thereof, and an oxygen feed electrode formed in said first air duct; and

an oxygen pump cell comprising an oxygen discharge electrode provided on the surface of an upper layer of the solid electrolyte layers forming said three layers, and an oxygen feed electrode formed in said first air duct;

wherein a constant current source/controller is arranged between the oxygen discharge electrode and the oxygen feed electrode so that prescribed current flows therebetween.

17. A trace oxygen generating apparatus according to claim 16, comprising

a second air duct and an air reference electrode provided in said second air duct in addition to said first air duct;

wherein said air reference electrode forms a detecting cell which monitors a decrease in oxygen concentration caused by oxygen feed in the oxygen feed duct through a change in electromotive force by measuring electromotive force between the air reference electrode and the oxygen feed electrode in said oxygen feed duct.

18. A method of generating trace oxygen comprising the steps of:

feeding constant current to the oxygen pump cell comprising an oxygen feed electrode and an oxygen discharge electrode by activating a constant current source/controller so as to generate prescribed oxygen and operating an oxygen pump;

sending a gas from a carrier gas source to the oxygen pump;

receiving oxygen fed from the oxygen pump; and

feeding a carrier gas added with the resultant trace oxygen in a prescribed amount to a necessary point.

19. A method of generating trace oxygen comprising the steps of:

feeding constant current to an oxygen pump cell comprising an oxygen feed electrode and an oxygen discharge electrode by operating a constant current source/controller so as to generate prescribed oxygen, and operating an oxygen pump;

sending zero gas which is a carrier gas from a carrier gas source from which oxygen has been removed through an oxygen remover using a deoxidizer;

receiving oxygen fed from the oxygen pump; and

feeding a gas containing trace oxygen in a resultant

prescribed amount to places requiring such gas.

20. A method of generating trace oxygen comprising the steps of:

operating a constant current source/controller, and operating an oxygen pump by feeding constant current to an oxygen pump cell comprising an oxygen feed electrode and an oxygen discharge electrode so as to generate prescribed oxygen;

adding oxygen in a slight amount to a carrier gas from a carrier gas source, heating the resultant mixture to burn the combustible fraction, removing oxygen in an oxygen remover using a deoxidizer or the like, and sending a zero gas from which the combustible fraction and oxygen have been removed to the oxygen pump side;

receiving oxygen fed from the oxygen pump; and

feeding a gas containing trace oxygen in a resultant prescribed amount to laces requiring such gas.